

WHAT IS CLAIMED IS:

1. A method for determining the position of a user terminal, comprising:
receiving at the user terminal a plurality of digital television (DTV) broadcast signals
from a plurality of DTV transmitters, wherein each of the DTV signals is a European
5 Telecommunications Standards Institute (ETSI) Digital Video Broadcasting - Terrestrial
(DVB-T) signal;

determining a pseudo-range between the user terminal and each DTV transmitter
based on the DTV broadcast signals based on a known component in the DTV signals; and
determining a position of the user terminal based on the pseudo-ranges and a location
10 of each of the DTV transmitters.

2. The method of claim 1, wherein determining a position of the user terminal
comprises:

adjusting the pseudo-ranges based on a difference between a transmitter clock at one
15 of the DTV transmitters and a known time reference; and

determining the position of the user terminal based on the adjusted pseudo-ranges and
the location of each of the DTV transmitters.

3. The method of claim 1, wherein the known component is a scattered pilot
20 carrier.

4. The method of claim 1, wherein determining a position of the user terminal
comprises:

determining an offset between a local time reference in the user terminal and a master
25 time reference; and

determining the position of the user terminal based on the pseudo-ranges, the location
of each of the DTV transmitters, and the offset.

5. The method of claim 4, further comprising:

30 determining a subsequent position of the user terminal using the offset.

6. The method of claim 1, wherein determining a pseudo-range comprises:
storing a portion of each of the DTV signals; and
subsequently correlating each of the stored portions and a signal generated by the user
terminal to produce the pseudo-ranges.

7. The method of claim 1, wherein determining a pseudo-range comprises:
correlating each of the DTV signals with a signal generated by the user terminal as
the DTV signals are received to produce the pseudo-ranges.

8. The method of claim 1, wherein determining a position of the user terminal
comprises:
determining a general geographic area within which the user terminal is located; and
determining the position of the user terminal based on the pseudo-ranges and the
general geographic area.

9. The method of claim 8, wherein the general geographic area is a footprint of
an additional transmitter communicably linked to the user terminal.

10. The method of claim 1, wherein determining a position of the user terminal
comprises:
determining a tropospheric propagation velocity in a vicinity of the user terminal;
adjusting the value of each pseudo-range based on the tropospheric propagation
velocity; and
determining the position of the user terminal based on the adjusted pseudo-ranges and
the location of each of the DTV transmitters.

11. The method of claim 1, wherein determining a position of the user terminal
comprises:
adjusting each pseudo-range based on a terrain elevation in a vicinity of the user
terminal; and
determining the position of the user terminal based on the adjusted pseudo-ranges and
the location of each of the DTV transmitters.

12. The method of claim 1, further comprising:
selecting the DTV signals based on an identity of an additional transmitter
communicably linked to the user terminal and a stored table correlating the additional
transmitter and the received DTV broadcast signals.

13. The method of claim 1, further comprising:
accepting a location input from a user; and
selecting the DTV signals based on the location input.

14. The method of claim 1, further comprising:
scanning available DTV signals to assemble a fingerprint of the location; and
selecting the DTV broadcast signals used to determine the pseudo-ranges based on
the fingerprint and a stored table that matches known fingerprints with known locations.

15. The method of claim 1, further comprising:
using receiver autonomous integrity monitoring (RAIM) to check the integrity of
each pseudo-range based on redundant pseudo-ranges from the DTV transmitters.

16. A method for determining the position of a user terminal, comprising:
receiving at the user terminal a plurality of digital television (DTV) broadcast signals
from a plurality of DTV transmitters, wherein each of the DTV signals is a European
Telecommunications Standards Institute (ETSI) Digital Video Broadcasting - Terrestrial
(DVB-T) signal;
determining a pseudo-range between the user terminal and each DTV transmitter
based on the DTV broadcast signals; and
transmitting the pseudo-ranges to a location server configured to determine a position
of the user terminal based on the pseudo-ranges and a location of each of the DTV
transmitters.

17. The method of claim 16, wherein determining a pseudo-range comprises:

determining a time of transmission from one of the DTV transmitters of a known component of the DTV broadcast signal;

determining a time of reception at the user terminal of the known component; and

determining the difference between the time of transmission and the time of reception.

18. The method of claim 16, wherein the known component is a scattered pilot carrier.

19. The method of claim 16, wherein determining a pseudo-range comprises: storing a portion of each of the DTV signals; and subsequently correlating each of the stored portions and a signal generated by the user terminal to produce the pseudo-ranges.

20. The method of claim 16, wherein determining a pseudo-range comprises: correlating each of the DTV signals with a signal generated by the user terminal as the DTV signals are received to produce the pseudo-ranges.

21. A method for determining the position of a user terminal, comprising: receiving a plurality of pseudo-ranges from a user terminal, each pseudo-range determined between the user terminal and one of a plurality of DTV transmitters based on DTV signals broadcast by the DTV transmitters, wherein each of the DTV signals is a European Telecommunications Standards Institute (ETSI) Digital Video Broadcasting - Terrestrial (DVB-T) signal, and wherein the pseudo-ranges are determined based on a known component in the DVB-T signals; and

determining a position of the user terminal based on the pseudo-ranges and a location of each of the DTV transmitters.

22. The method of claim 21, wherein determining a position of the user terminal comprises:

adjusting the pseudo-ranges based on a difference between a transmitter clock at one of the DTV transmitters and a known time reference; and

determining the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

5 23. The method of claim 21, wherein the known component is a scattered pilot carrier.

24. The method of claim 21, wherein determining a position of the user terminal comprises:
determining an offset between a local time reference in the user terminal and a master
10 time reference; and
determining the position of the user terminal based on the pseudo-ranges, the location of each of the DTV transmitters, and the offset.

15 25. The method of claim 24, further comprising:
determining a subsequent position of the user terminal using the offset.

26. The method of claim 21, wherein determining a position of the user terminal comprises:
determining a general geographic area within which the user terminal is located; and
20 determining the position of the user terminal based on the pseudo-ranges and the general geographic area.

27. The method of claim 26, wherein the general geographic area is a footprint of an additional transmitter communicably linked to the user terminal.

25 28. The method of claim 21, wherein determining a position of the user terminal comprises:

determining a tropospheric propagation velocity in a vicinity of the user terminal;
adjusting the value of each pseudo-range based on the tropospheric propagation
30 velocity; and

determining the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

29. The method of claim 21, wherein determining a position of the user terminal comprises:

adjusting each pseudo-range based on the terrain elevation in the vicinity of the user terminal; and

determining the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

30. An apparatus for determining the position of a user terminal, comprising:

means for receiving at the user terminal a plurality of digital television (DTV) broadcast signals from a plurality of DTV transmitters, wherein each of the DTV signals is a European Telecommunications Standards Institute (ETSI) Digital Video Broadcasting - Terrestrial (DVB-T) signal;

means for determining a pseudo-range between the user terminal and each DTV transmitter based on a known component in the DTV broadcast signals; and

means for determining a position of the user terminal based on the pseudo-ranges and a location of each of the DTV transmitters.

31. The apparatus of claim 30, wherein means for determining a position of the user terminal comprises:

means for adjusting the pseudo-ranges based on a difference between a transmitter clock at one of the DTV transmitters and a known time reference; and

means for determining the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

32. The apparatus of claim 31, wherein the known component is a scattered pilot carrier.

33. The apparatus of claim 30, wherein means for determining a position of the user terminal comprises:

means for determining an offset between a local time reference in the user terminal and a master time reference; and

means for determining the position of the user terminal based on the pseudo-ranges, the location of each of the DTV transmitters, and the offset.

34. The apparatus of claim 33, further comprising:

means for determining a subsequent position of the user terminal using the offset.

35. The apparatus of claim 30, wherein means for determining a pseudo-range comprises:

means for storing a portion of each of the DTV signals; and

means for subsequently correlating each of the stored portions and a signal generated by the user terminal to produce the pseudo-ranges.

36. The apparatus of claim 30, wherein means for determining a pseudo-range comprises:

means for correlating each of the DTV signals with a signal generated by the user terminal as the DTV signals are received to produce the pseudo-ranges.

37. The apparatus of claim 30, wherein means for determining a position of the user terminal comprises:

means for determining a general geographic area within which the user terminal is located; and

means for determining the position of the user terminal based on the pseudo-ranges and the general geographic area.

38. The apparatus of claim 37, wherein the general geographic area is a footprint of an additional transmitter communicably linked to the user terminal.

39. The apparatus of claim 30, wherein means for determining a position of the user terminal comprises:

means for determining a tropospheric propagation velocity in the vicinity of the user terminal;

means for adjusting the value of each pseudo-range based on the tropospheric propagation velocity; and

means for determining the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

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40. The apparatus of claim 30, wherein means for determining a position of the user terminal comprises:

means for adjusting each pseudo-range based on a terrain elevation in a vicinity of the user terminal; and

10 means for determining the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

41. The apparatus of claim 30, further comprising:

15 means for selecting the DTV signals based on an identity of an additional transmitter communicably linked to the user terminal and a stored table correlating the additional transmitter and the received DTV broadcast signals.

42. The apparatus of claim 30, further comprising:

means for accepting a location input from a user; and

20 means for selecting the DTV signals based on the location input.

43. The apparatus of claim 30, further comprising:

means for scanning available DTV signals to assemble a fingerprint of the location; and

25 means for selecting the DTV broadcast signals used to determine the pseudo-ranges based on the fingerprint and a stored table that matches known fingerprints with known locations.

44. The apparatus of claim 30, further comprising:

30 means for using receiver autonomous integrity monitoring (RAIM) to check the integrity of each pseudo-range based on redundant pseudo-ranges from the DTV transmitters

45. An apparatus for determining the position of a user terminal, comprising:
means for receiving at the user terminal a plurality of digital television (DTV)
broadcast signals from a plurality of DTV transmitters, wherein each of the DTV signals is a
European Telecommunications Standards Institute (ETSI) Digital Video Broadcasting -
5 Terrestrial (DVB-T) signal;

means for determining a pseudo-range between the user terminal and each DTV
transmitter based on a known component in the DTV broadcast signals; and

means for transmitting the pseudo-ranges to a location server configured to determine
a position of the user terminal based on the pseudo-ranges and a location of each of the DTV
10 transmitters.

46. The apparatus of claim 45, wherein means for determining a pseudo-range
comprises:

means for determining a time of transmission from one of the DTV transmitters of a
15 component of the DTV broadcast signal;

means for determining a time of reception at the user terminal of the component; and
means for determining the difference between the time of transmission and the time
of reception.

47. The apparatus of claim 45, wherein the component is a scattered pilot carrier.

48. The apparatus of claim 45, wherein means for determining a pseudo-range
comprises:

means for storing a portion of each of the DTV signals; and

25 means for subsequently correlating each of the stored portions and a signal generated
by the user terminal to produce the pseudo-ranges.

49. The apparatus of claim 45, wherein means for determining a pseudo-range
comprises:

30 means for correlating each of the DTV signals with a signal generated by the user
terminal as the DTV signals are received to produce the pseudo-ranges.

50. An apparatus for determining the position of a user terminal, comprising:
means for receiving a plurality of pseudo-ranges from a user terminal, each pseudo-range determined between the user terminal and one of a plurality of DTV transmitters based on DTV signals broadcast by the DTV transmitters, wherein each of the DTV signals is a
5 European Telecommunications Standards Institute (ETSI) Digital Video Broadcasting - Terrestrial (DVB-T) signal, and wherein the pseudo-ranges are determined based on a known component in the DTV signals; and

means for determining a position of the user terminal based on the pseudo-ranges and a location of each of the DTV transmitters.

10 51. The apparatus of claim 50, wherein means for determining a position of the user terminal comprises:

means for adjusting the pseudo-ranges based on a difference between a transmitter clock at one of the DTV transmitters and a known time reference; and

15 means for determining the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

20 52. The apparatus of claim 50, wherein the known component is a scattered pilot carrier.

25 53. The apparatus of claim 50, wherein means for determining a position of the user terminal comprises:

means for determining an offset between a local time reference in the user terminal and a master time reference; and

30 means for determining the position of the user terminal based on the pseudo-ranges, the location of each of the DTV transmitters, and the offset.

54. The apparatus of claim 53, further comprising:

means for determining a subsequent position of the user terminal using the offset.

55. The apparatus of claim 50, wherein means for determining a position of the user terminal comprises:

means for determining a general geographic area within which the user terminal is located; and

means for determining the position of the user terminal based on the pseudo-ranges and the general geographic area.

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56. The apparatus of claim 55, wherein the general geographic area is a footprint of an additional transmitter communicably linked to the user terminal.

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57. The apparatus of claim 50, wherein means for determining a position of the user terminal comprises:

means for determining a tropospheric propagation velocity in a vicinity of the user terminal;

means for adjusting the value of each pseudo-range based on the tropospheric propagation velocity; and

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means for determining the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

58. The apparatus of claim 50, wherein means for determining a position of the user terminal comprises:

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means for adjusting each pseudo-range based on the terrain elevation in the vicinity of the user terminal; and

means for determining the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

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59. A computer program product, tangibly stored on a computer-readable medium, for determining the position of a user terminal, comprising instructions operable to cause a programmable processor to:

receive at the user terminal a plurality of digital television (DTV) broadcast signals from a plurality of DTV transmitters, wherein each of the DTV signals is a European Telecommunications Standards Institute (ETSI) Digital Video Broadcasting - Terrestrial (DVB-T) signal;

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determine a pseudo-range between the user terminal and each DTV transmitter based on a known component in the DTV broadcast signals; and

determine a position of the user terminal based on the pseudo-ranges and a location of each of the DTV transmitters.

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60. The computer program product of claim 59, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to:

10 adjust the pseudo-ranges based on a difference between a transmitter clock at one of the DTV transmitters and a known time reference; and

determine the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

15 61. The computer program product of claim 59, wherein the known component is a scattered pilot carrier.

20 62. The computer program product of claim 59, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to:

determine an offset between a local time reference in the user terminal and a master time reference; and

determine the position of the user terminal based on the pseudo-ranges, the location of each of the DTV transmitters, and the offset.

25 63. The computer program product of claim 62, further comprising instructions operable to cause a programmable processor to:

determine a subsequent position of the user terminal using the offset.

30 64. The computer program product of claim 59, wherein instructions operable to cause a programmable processor to determine a pseudo-range comprise instructions operable to cause a programmable processor to:

store a portion of each of the DTV signals; and

subsequently correlate each of the stored portions and a signal generated by the user terminal to produce the pseudo-ranges.

65. The computer program product of claim 59, wherein instructions operable to cause a programmable processor to determine a pseudo-range comprise instructions operable to cause a programmable processor to:

correlate each of the DTV signals with a signal generated by the user terminal as the DTV signals are received to produce the pseudo-ranges.

66. The computer program product of claim 59, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to:

determine a general geographic area within which the user terminal is located; and
determine the position of the user terminal based on the pseudo-ranges and the general geographic area.

67. The computer program product of claim 66, wherein the general geographic area is a footprint of an additional transmitter communicably linked to the user terminal.

68. The computer program product of claim 59, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to

determine a tropospheric propagation velocity in a vicinity of the user terminal;
adjust the value of each pseudo-range based on the tropospheric propagation velocity;

and

determine the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

69. The computer program product of claim 59, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to:

adjust each pseudo-range based on the terrain elevation in the vicinity of the user terminal; and

determine the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

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70. The computer program product of claim 59, further comprising instructions operable to cause a programmable processor to:

select the DTV signals based on an identity of an additional transmitter communicably linked to the user terminal and a stored table correlating the additional transmitter and the received DTV broadcast signals.

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71. The computer program product of claim 59, further comprising instructions operable to cause a programmable processor to:

accept a location input from a user; and
select the DTV signals based on the location input.

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72. The computer program product of claim 59, further comprising instructions operable to cause a programmable processor to:

scan available DTV signals to assemble a fingerprint of the location; and
select the DTV broadcast signals used to determine the pseudo-ranges based on the fingerprint and a stored table that matches known fingerprints with known locations.

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73. The computer program product of claim 59, further comprising instructions operable to cause a programmable processor to:

use receiver autonomous integrity monitoring (RAIM) to check the integrity of each pseudo-range based on redundant pseudo-ranges from the DTV transmitters

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74. A computer program product, tangibly stored on a computer-readable medium, for determining the position of a user terminal, comprising instructions operable to cause a programmable processor to:

receive at the user terminal a plurality of digital television (DTV) broadcast signals from a plurality of DTV transmitters, wherein each of the DTV signals is a European

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Telecommunications Standards Institute (ETSI) Digital Video Broadcasting - Terrestrial (DVB-T) signal;

determine a pseudo-range between the user terminal and each DTV transmitter based on a known component in the DTV broadcast signals; and

5 transmit the pseudo-ranges to a location server configured to determine a position of the user terminal based on the pseudo-ranges and a location of each of the DTV transmitters.

75. The computer program product of claim 74, wherein instructions operable to cause a programmable processor to determine a pseudo-range comprise instructions operable to cause a programmable processor to:

10 determine a time of transmission from one of the DTV transmitters of a component of the DTV broadcast signal;

determine a time of reception at the user terminal of the component; and

15 determining the difference between the time of transmission and the time of reception.

76. The computer program product of claim 74, wherein the component is a scattered pilot carrier.

20 77. The computer program product of claim 74, wherein instructions operable to cause a programmable processor to determine a pseudo-range comprise instructions operable to cause a programmable processor to:

store a portion of each of the DTV signals; and

25 subsequently correlate each of the stored portions and a signal generated by the user terminal to produce the pseudo-ranges.

78. The computer program product of claim 74, wherein instructions operable to cause a programmable processor to determine a pseudo-range comprise instructions operable to cause a programmable processor to:

30 correlate each of the DTV signals with a signal generated by the user terminal as the DTV signals are received to produce the pseudo-ranges.

79. A computer program product, tangibly stored on a computer-readable medium, for determining the position of a user terminal, comprising instructions operable to cause a programmable processor to:

receive a plurality of pseudo-ranges from a user terminal, each pseudo-range determined between the user terminal and one of a plurality of DTV transmitters based on DTV signals broadcast by the DTV transmitters, wherein each of the DTV signals is a European Telecommunications Standards Institute (ETSI) Digital Video Broadcasting - Terrestrial (DVB-T) signal, and wherein the pseudo-ranges are determined based on a known component in the DTV signals; and

determine a position of the user terminal based on the pseudo-ranges and a location of each of the DTV transmitters.

80. The computer program product of claim 79, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to:

adjust the pseudo-ranges based on a difference between a transmitter clock at one of the DTV transmitters and a known time reference; and

determine the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

81. The computer program product of claim 79, wherein the known component is a scattered pilot carrier.

82. The computer program product of claim 79, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to:

determine an offset between a local time reference in the user terminal and a master time reference; and

determine the position of the user terminal based on the pseudo-ranges, the location of each of the DTV transmitters, and the offset.

83. The computer program product of claim 82, further comprising instructions operable to cause a programmable processor to:
determine a subsequent position of the user terminal using the offset.

5 84. The computer program product of claim 79, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to:

determine a general geographic area within which the user terminal is located; and
determine the position of the user terminal based on the pseudo-ranges and the
10 general geographic area.

85. The computer program product of claim 84, wherein the general geographic area is a footprint of an additional transmitter communicably linked to the user terminal.

15 86. The computer program product of claim 79, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to:

determine a tropospheric propagation velocity in the vicinity of the user terminal;
adjust the value of each pseudo-range based on the tropospheric propagation velocity;
and
20 determine the position of the user terminal based on the adjusted pseudo-ranges and the location of each of the DTV transmitters.

25 87. The computer program product of claim 79, wherein instructions operable to cause a programmable processor to determine a position of the user terminal comprise instructions operable to cause a programmable processor to:

adjust each pseudo-range based on the terrain elevation in the vicinity of the user terminal; and

determine the position of the user terminal based on the adjusted pseudo-ranges and
30 the location of each of the DTV transmitters.